



INSTRUCTION FOR USE

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Increment Borer SUUNTO

300 mm / 400 mm



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Imprint



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Introduction

Increment Borer 'SUUNTO'

Extraction of core samples

SUUNTO Increment Borers are used for measuring the growth rate of a standing tree and for checking the quality of wood.

Increment Borers are made of special steel (teflon coated).

This Increment Borer consists of three parts:

1. Handle
2. Bit
3. Extracteur



Increments Borers are used for

- determining the age of standing trees
- visual assessment of the core samples for substantial information about the rate of growth and compartmentalization of decay
- assessment of the actual physical condition of the tree with evaluation of its history by means of an annual ring analysis
- detection of discoloration's in the wood
- enables the microscopic evaluation of the wood
- measuring the growth rate of standing trees
- checking for defects inside trees
- testing the condition of wooden structures

Technical Data

- Diameter core: 5 mm
- Drilling depths: 300/400 mm
- 2-spirals for hard wood (2N)
- 3-spirals for resinous and soft wood (3N)



2-spirals 2N (hard wood)



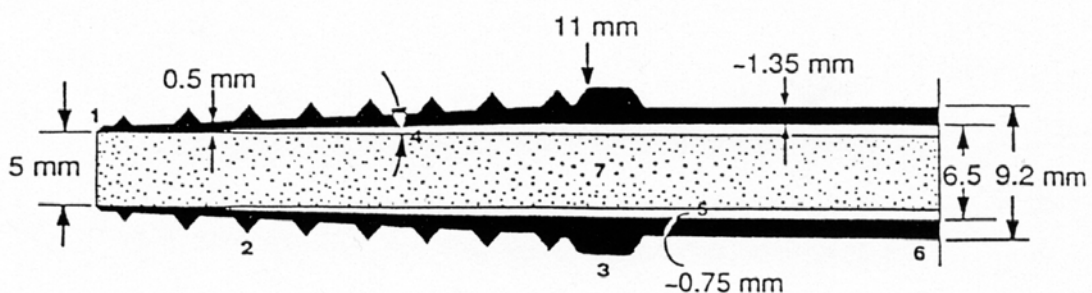
3-spirals 3N (resinous and soft wood)

Instruction

Introduction

The Increment Borer is employed for **Tree Care**. The following is a description of correct application and care as well as the different possibilities of employment. Considering the damage to the tree, a mere on-the-spot examination of a drilling core is advisable only if the entire information potential of a drilling sample is exhausted - either for a stability check by means of the **Fractometer** (bending strength and compressive strength measurement) or for an assessment of the actual physical condition of the tree, incl. the previous long-years' development of the tree, by means of an annual ring analysis (**IML-Measuring Table**).

Structure of the Increment Borer



- | | | | | | |
|---|--------------|---|----------------|---|----------------------------------|
| 1 | Cutting edge | 3 | Spreader cams | 5 | Clearance between core and drill |
| 2 | Helix | 4 | Aperture angle | 6 | Shaft |
| | | | | 7 | Core |

The cutting edge forms an angle towards the outside and cuts the drilling core out of the live wood (the Increment Borer is less suited for dry wood). The helix only serves for the advance and return feed of the drill in the trunk. The cams at the rear end of the helix serve for increasing the displacement of the surrounding wood in order to reduce the frictional resistance acting on the drill shaft.

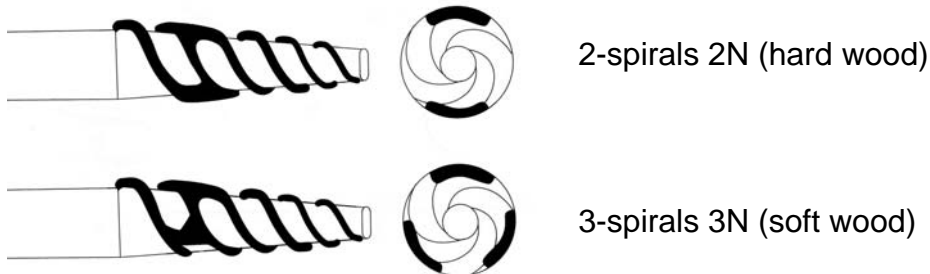
On the inside as well, the drill head has a conical shape, which allows the drilling core (\varnothing of the interior cutting edge: 5.0 mm) to slide into the shaft without friction and leaves a clearance for the drill tongue. The width and the curvature of the drill tongue have been adjusted to the interior shaft diameter and the drilling core. To prevent damage to the tapering drill head, the length of the tongue remains slightly under the entire drill length (300 or 400 mm).

Instruction

Drill Types

There are several versions of the Increment Borer available from IML, differing with respect to the diameter and length of the drilling core (length: 300 or 400 mm – Ø 5.0 mm). Thanks to its Teflon coating, the frictional resistance during the drilling procedure is reduced and the device is protected from corrosion. There is a special Increment Borer for softwood (3-part helix with large helix angle) and one for hardwood (2-part helix with small helix angle).

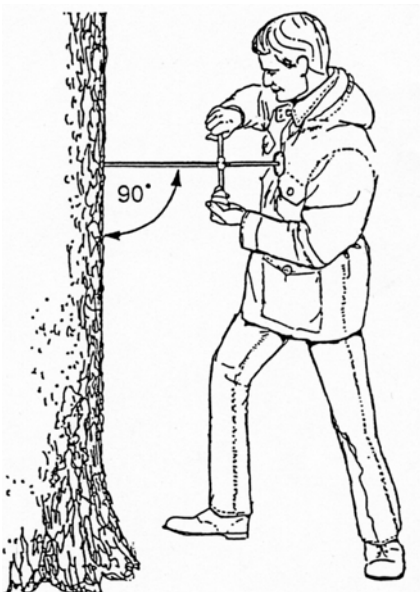
It is important to choose the appropriate type of drill, as a high exertion involves the risk of the rotation not being correctly effected and, thus, the drill being bent. The hardened steel is rather brittle and, therefore, tends to break. Drill, tongue, and handle are separately available as spare parts (see 'Accessories'). As a rule, parts from different manufacturers cannot be combined, as the different makes are not harmonized with each other.



Extraction of core samples

Alignment to the drill

Applying and turning the Increment Borer



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Instruction

Once the desired drilling depth has been reached (position of the medulla), insert the drill tongue into the drill by sliding it carefully along the interior of the drill in order to move it within the clearance between the drilling core and the drill (avoiding any effort as the tongue tends to bend and to break and as the drilling core is very fragile). Now turn the drill back anticlockwise by a full or half rotation.

Thus, the drilling core is torn off the wood. Carefully pull the drilling core off the drill on the tongue. Then immediately remove the Increment Borer from the tree as the displaced wood usually won't expand slowly but bounce back and, thus, may wedge the drill in. Turn the drill off by applying a slight traction (**Attention:** no worn-out locking bar!).

Position of sample taking

The decision in which position on the bole the sample is to be taken depends on the questions to be answered by the drilling core:

General conditions, growth dynamic

- Apply the drill at chest level (forestry measure: 1.3 m above ground) in an evenly grown position
- Do not apply the drill in a direct line above a main root (better supply of the tree) nor in the furrow between two main roots (supply shadow).
- Do not apply the drill directly above or below any knotholes/ stubs/ branches;
- if possible, apply it at another level and/ or beside such areas.
- Do not apply the drill directly above or below an injury or a rotten area or in overgrowth areas, if possible, apply it at another level and/ or beside such areas.
- Do not apply the drill in compression wood or tension wood, that is, in case of softwood trees standing on a slope or in inclined position, not on the lower surface, in case of hardwood trees, not on the upper surface of the bole.

Age of tree

- Apply the drill as lowly on the tree as possible in an evenly grown area.

Time of injury

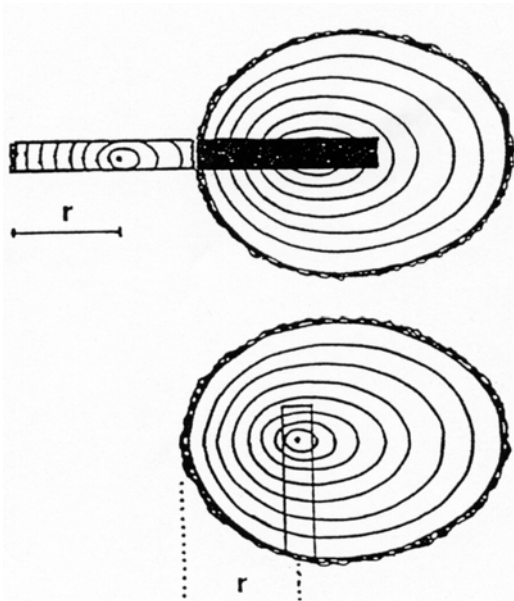
Apply the drill in the outer marginal zone of the overgrowth area beside the injury.

Attention: By drilling, the separation wall (CODIT wall 4) will be pierced, which may result in an infection easily spreading from the interior into the newly formed wood. Therefore, if it is not definitely necessary to find out the time when the injury has happened, you should avoid drilling into the overgrowth area.

Instruction

Condition of the wood, wall thickness of the healthy wood

Radial alignment of the Increment Borer



Aligning the drill vertically to the medulla is somewhat difficult if the tree hasn't grown concentrically. In case of an inclined tree or a tree standing on a slope, you may have to effect two drilling procedures. Take the drilling core along the larger diameter of the tree with the oval cross section from that side of the tree that is opposite to the compression wood / tension wood. The approximate position of the medulla can be seen on the drilling core. Effect the second drilling along the shorter diameter of the tree (at a right angle to the first sample-taking and at a slightly different level), aligning the drill to the radius of the medulla.

In the case of softwood trees, such as spruce, fir, larch, etc., alignment of the drill may often be oriented by the distribution of the branches, provided that the mechanical load conditions in the bole between the position of the drill and the crown line do not change (crookedness, tree top rupture).

Record

Increment examinations are completed by a visual assessment of the exterior condition of the tree (VTA) This does not only support the interpretation of the growth process, but also, if the tree is repeatedly examined, facilitates follow-up of its further development (success check of the care measures). Standardizing the recording of the tree condition facilitates work and allows a cross comparison between different trees. Whether the assessment is effected with respect to quality only (e.g. thawing salt necrosis: yes/ no, serious/ week) or with respect to quantity (e.g. thawing salt necrosis: 30%) will depend on the respective requirements. If the assessment simultaneously serves as an inventory of the condition of a larger group of trees, it will usually be effected in the middle of summer (July, August). If it serves as additional information to the individual increment analyses, it will be affected at the time of sample-taking.

The drilling record describes the situation of the site, the size of the tree, the position of sample-taking (sketch), and the condition of the tree and the crown. The girth of the tree at sample-taking level is of essential importance to enable assessment of the missing part up to the medulla in case of an incomplete drilling core (large tree diameter, hollow tree, tree with rotten heart, etc.) or the eccentricity of the position of the medulla in the bole ($U = 2\pi r$, $\pi = 3.14\dots$ $r = U:6$).

Instruction

If during sample-taking putrid water (wet heart, water-filled hollow bole) or a strong odour of putridity (fermentation gas as a waste product from bacterial metabolism) should penetrate from the drilling hole, such phenomena will be recorded under 'Special features'. The odour and the colour of the drilling core will be determined and recorded immediately after sample-taking, as these parameters will change soon in the transportation container and during the drying process.

Difficulties during sample-taking

High or low resistance when turning in the Increment Borer:

If while turning in the drill, you suddenly become aware of a higher resistance, stop sample-taking (pull the drilling core off the drill!) and repeat it at another part of the bole. Such a sudden increase of resistance indicates that the drill has hit an intergrown dead branch.

Likewise stop the drilling procedure if, while turning in the drill, you suddenly feel a decrease of the resistance (pull the drilling core off the drill!). In this case, the drill head has hit a rotten area or a cavity. Pull the drill out slowly and applying tension until the resistance increases in order to avoid idle rotation of the drill.

Jamming of the Increment Borer in the Tree:

If the drill turns without backward feed and your body weight is not enough to exercise sufficient tensile force, you may try to pull the drill off the bole by means of a tackle line (simultaneously turning the handle!). When connecting the tackle line to the drill handle, make sure to adhere to the direction of the drill. (In case of force acting at an angle, the drill will immediately break!)

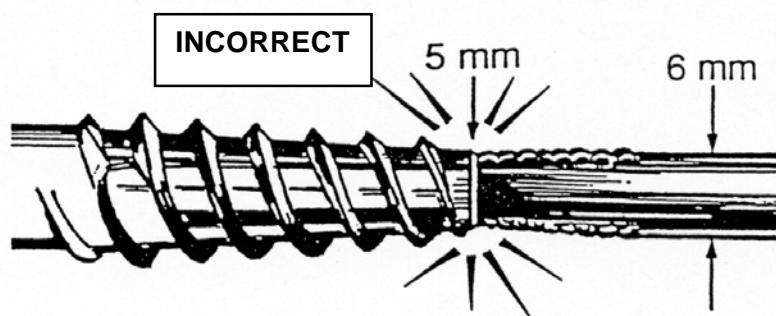
A broken drill should be sawn off flush with the tree (steel saw), on the one hand, to prevent the risk of injury on the sharp-edged end piece that can easily be overlooked and, on the other hand, to allow quick overgrowing of the foreign body.

Clogged Increment Borer:

If you cannot remove the drilling core from the drill because it has been squeezed, remove the drill with the core from the tree. Under no circumstances must the drill tongue be inserted into the drill from the front (head side) in an effort to push the wood back! Put the drill in a warm place for several hours (heating, stove) to allow the jammed wood to dry. You may push the drilling core off the drill by means of the **Ejector** (see 'Accessories').

Instruction

Clearing the clogged drill



You must not use the drill tongue to clear a clogged Increment Borer as the width of the tongue is larger than the interior diameter of the cutting edge of the drill (the cutting edge will be deformed or break = destruction of the drill)!

Torn-out locking bar

Owing to the high load the locking bar is exposed to in the very small area of contact with the tail piece of the drill, the half-round aperture of the locking bar will be worn off relatively soon. Then, firm attachment of the handle is no longer possible and, thus, turning the drill off the tree by applying tension becomes more difficult. For safe attachment, replacement locking bars from hardened steel (see 'Accessories') are available.

Locking bar



Causes and consequences of bad drilling core quality

Torn drilling core or cores with rough surface:

The cutting edge of the drill is not sharp! The fragments and the roughness of the surface increase the risk of the drilling core to get jammed in the drill when the tongue is inserted. If a drilling core is torn into short pieces, the order of these pieces is unsure or incomplete and, thus, will not allow an interpretation.

(Mainly in the interior of the bole, radial or tangential cracks are frequently encountered. These have, however, smooth edges and follow the structure of the wood, which usually allows differentiating them from crack formation through sample-taking!)

Instruction

Helically twisted drilling core:

The cutting edge of the drill is deformed (protrusion, ovalization) or shows a notch (e.g. from inserting the tongue from the head side). If the core is strongly twisted, it will be torn into small pieces. Twisted drilling cores will make the interpretation much more difficult.

Waved, compressed drilling core:

The cutting edge of the drill is not sharp and/or deformed, or a mistake has been made when applying the drill to the tree. Compression of the wood texture will make the interpretation more difficult.

Subsequent staining of the drilling core:

The wood has dried too slowly as the drilling core has been left in the transport container for too long. Correct analysis of the condition of the wood will not be possible.

Subsequent bending of the drilling core:

The drilling core had not been fixed during the drying process!
Correct interpretation will not be possible.

Maintenance of the Increment Borer

There are two things about the accretion drill that require regular care:

Blunting of the cutting edge and susceptibility to corrosion!

Cleaning the Increment Borer:

Dirt particles, resin residues, and corrosion on the exterior of the drill will increase the frictional resistance during sample-taking and, thus, the risk of the steel breaking. On the inside of the drill, a smooth, clean surface is a prerequisite of the drilling core not being jammed or squeezed, thus clogging the drill. As with every tool, thorough maintenance will prolong the service life of the Increment Borer and facilitate your work. Therefore, clean the drill after each use on the outside and on the inside, allow it to dry and oil it (see 'Accessories').

Instructions:

Clean the drill on the outside first by means of a dry, then an oiled cloth (fine oil). If an uncoated drill is corroded on its entire shaft length, remove the rust by means of a fine-grained, oiled sanding paper (grain 400 - 600), the same applies to the helix.

Cleaning on the inside will be done by means of an oil-impregnated cleaning brush with lengthening bar (see 'Accessories'). Sticking resin residues may be removed by means of alcohol. **Never clean** the interior of the drill but from the end!

When moving the brush forward and backward, it must not be pushed totally up to the cutting edge (blunting!). Store the oiled Increment Borer in the dry handle.

Instruction

Likewise clean and oil the drill tongue. Sand off any rust. Bend in shape any deformed edges inasmuch as possible to prevent the drilling core from getting jammed and the tongue from causing notches in the drill.

Disinfection of the Increment Borer:

If the drill requires disinfection, this should be done with a chlorinated agent such as Javel- water (a bleaching agent used in household). Alcohol won't perfectly eliminate fungus spores and micro organisms. Apart from that, you may slowly heat up an uncoated drill to a high temperature.

Regrinding of the Increment Borer:

The cutting edge requires periodical regrinding, as it will quickly wear off, particularly when used in hardwood. Regrinding will have to be done very carefully, as the cutting edge easily deforms if the grinding stone is not applied correctly (= destruction of the drill!)

When grinding the exterior of the cutting edge, use a flat grinding stone.

Hold the drill head with one hand; tuck the drill end under your arm.

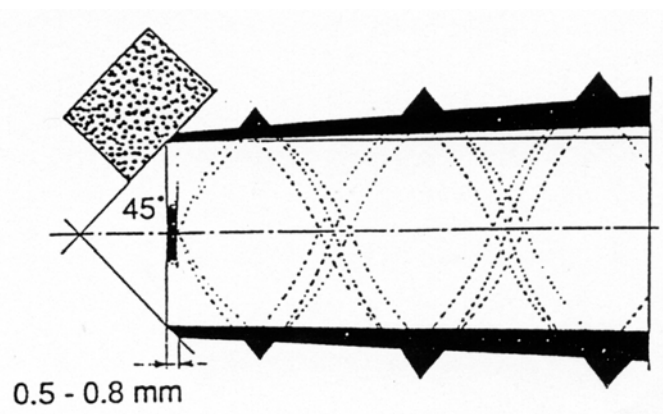
Then by slowly turning the drill, pull the grinding stone softly (no pressure!) over the cutting surface at a 45°- angle. Grind the inner side of the cutting edge by means of a round, conical grinding stone, not inserting the grinding stone straight into the drill opening, but moving it along the conical interior surface of the drill head!

Note: the grinding stone must not be completely inserted so as to fill the entire drill opening. Effect this procedure by regularly, slowly turning the drill to avoid that the cutting edge be ground asymmetrically (ovalization of the opening!).

Do not use the grinding stones but impregnated with oil.

Very small notches in the cutting edge may be ground off.
The helix cannot be sharpened.

Regrinding of the cutting edge on the outside

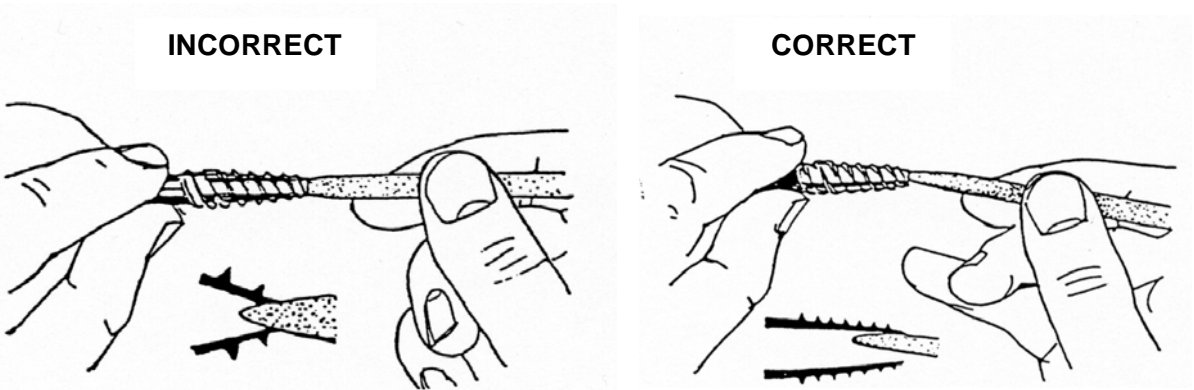


Instruction

Place the grinding stone flat on the cutting surface that is at an angle of 45° with respect to the drill shaft. Regularly and softly move the grinding stone over the cutting edge while slowly turning the drill.

(The sketch shows the cross section of the grinding stone. The grinding motion is effected vertically with respect to the image area).

Regrinding of the cutting edge on the inside



Move the grinding stone forward and backward along the conical inside, making sure that the grinding stone never completely fills the entire drill opening! If you don't effect this correctly, the cutting edge will be enlarged entirely or partially. This would lead to the drilling core cut out being too large or unevenly shaped and, therefore, compressed and twisted immediately behind the cutting edge.

The maintenance set comprises:

(see accessories item number: 4000127)

- ejector for cores
- conical grindstone for interior, straight grindstone for exterior of the drill
- cleaning brush with extension
- oil can
- 2 spare drill locks

Preparation of the drilling core

Transportation

Carefully detach the drilling core removed from the drill from the front end of the tongue, on which it is cramped in the zone of the grooved tongue edge. If the drilling core has been broken into pieces, number these (order and longitudinal orientation are of great importance!). Either fix the core on supporting battens on the spot or store it in the transport container. At any rate will the drilling core have to allow later assignment? Therefore, the description should comprise the location, the tree, the species of tree, the date, and the sample number (in case of several samples taken, per tree) or the tree number (in case of several trees of the same species).

Instruction

There are several options for transportation of the drilling core: Roll an intact hardwood core into strong paper, bend the paper roll ends and store the core break proof in a box. Softwood cores, broken drilling cores or drilling cores with putrid zones will require more stable containers, such as tubes (e.g. cardboard or plastic). The fresh drilling core must not be stored in a container that is permeable to moisture or air but for a very short time, as even on healthy wood, fungi or bacteria colonies may develop, which would lead to staining affecting the diagnosis of the state of the wood.

Fixing and preparation of the untreated drilling core:

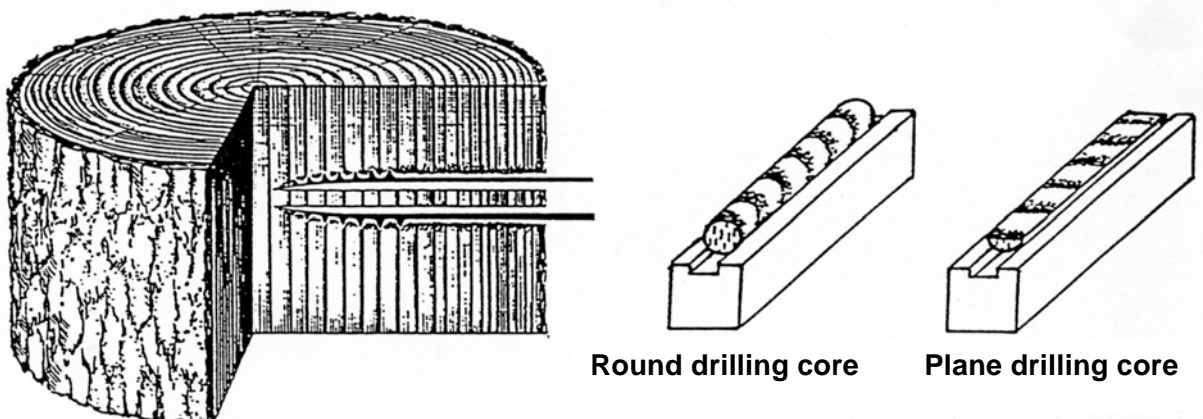
Fix the fragile drilling core as long as it is still fresh and humid to prevent it from bending during the drying process.

Carefully remove the bark and the bast from the core (green sapwood tends to crack!). Now glue the outer end of the drilling core into the groove of the supporting batten (wood glue - see 'Accessories') and fix by means of several strips of waterproof adhesive tape. The supporting batten may then be lettered (tree species, location, tree or sample number, date...) and the drilling core is allowed to dry at room temperature.

Important

Correct alignment of the drilling core on the supporting batten is of greatest importance (see 'Accessories') Fix the drilling core on the batten in such a way that the axial direction of the wood grains is vertical to the top surface of the batten. The grain direction can be seen on the cross sectional area of the drilling core. You will have to consider both ends of the core. If the grain direction is twisted between the outer and the inner end (twisted grain), the drilling core will have to be cut into two or more pieces and each piece will have to be glued on a supporting batten in correct (vertical) alignment.

Alignment of the drilling core on the supporting batten



Round drilling core

Plane drilling core

Instruction

The axial direction of the wood grains is vertical to the supporting batten. Upon removal of the upper half of the drilling core, the top surface corresponds with the cross sectional area of the tree.

Once the drilling core has completely dried (1- 2 days), remove the strips of adhesive tape. Grind off the upper half of the round drilling core or carefully cut it off by means of a carpeting knife with a sharp blade. The ground or cut surface must not show any scratches and it will have to form an exact 90°- angle with respect to the grain direction. Do not apply too much pressure on the drilling core while grinding, as the frictional heat thus generated may affect the drilling core.

Damage to the tree through drilling

Each drilling means a local mechanical and physiological damage to the wood, which the tree will have to limit through certain energy and material expenditure for compartmentation and overgrowth.

This results in the principle that the Increment Borer should only be employed in perfect condition (sharp cutting edge etc.). Responsible employment of the drill requires technical knowledge and an optimal exhaustion of the information content of a drilling core.

The reaction of the wood to the drilling hole will differ as to the species and to the individual tree. Therefore, a general statement on the extent of damage to a certain tree is not possible. As a rule, it can be said that the damage is the more serious the weaker the condition of the tree is, the larger any existing putridity focuses in the tree are, which are cut open by the drill hole and the more drilling holes are made in the tree. Apart from that, seasonal differences both with a view to the risk of infection and to the reaction of the tree play an important part; in this respect as well each tree will react in a specific way. Hardwood trees tend to react to sample-taking by means of the Increment Borer during the vegetation period by less extensive staining than they do to drillings effected during winter time. In the case of softwood trees, things are the other way round.

Species-specific differences in the capability of compartmentation (Tab. 1)

(acc. to D. Dujesiefken 1991)

High capability of compartmentation	Low capability of compartmentation
Acer Carpinus Fagus Quercus Tilia	Aesculus Betula Fraxinus Malus Populus Prunus Salix Picea

Instruction

Up to the present, there is no knowledge as to how the drilling should be treated in order to exclude the risk of an infection of the wood by fungi and/ or bacteria. Keeping the drilling hole sterile is not possible even by microbicidal wound- sealing compounds. The capability of the tree is still of great importance as far as prevention or limitation of an infection is concerned.

As closing of the drilling hole by applying a wound- sealing compound, a dowel and/ or grafting wax will result in a humid space providing to wood pathogens (fungi, bacteria) even more ideal living conditions than there are in the dry wood, it is strongly recommended to leave the drilling hole open. The edges of the drilling hole should be cut even by means of a sharp knife to facilitate wound overgrowth. Coating the edge with a wound- sealing compound might bear a positive effect upon the overgrowing reaction as, thus, the cambium will dry out less.

Source: **Holz-Labor - Dr. K. Joos - Grenzacherstraße 215 - CH-4058 Basel**

Accessories

Increment Borer SUUNTO

	Item number:
Increment Borer "SUUNTO" 300 mm 3-spirals (3N)	4000120
Increment Borer "SUUNTO" 400 mm 3-spirals (3N)	4000121
Increment Borer "SUUNTO" 300 mm 2-spirals (2N)	4000118
Increment Borer "SUUNTO" 400 mm 2-spirals (2N)	4000119

Accessories optional

	Item number:
Maintenance set (individually)	4000127
Maintenance set incl. Increment Borer "SUUNTO" 400 mm	4000126
Ejector for cores	4000128
Lengthening piece withdrawal aid	4000145
IML Probe rod Standard length: 600 mm	4000147
Extension for IML probe rod Length: 300 mm	4000148
Analysis testing pin Length: 800 mm	4000146

Spare parts

	Item number:
Spare needle 300 mm	4000122
Spare needle 400 mm	4000142
Spare drill "SUUNTO" 300 mm 3-spirals (3N)	4000123
Spare drill "SUUNTO" 400 mm 3-spirals (3N)	4000124
Spare drill "SUUNTO" 300 mm 2-spirals (2N)	4000123-1
Spare drill "SUUNTO" 400 mm 2-spirals (2N)	4000124-1
Spare drill locks	4000127-1

Please ask us for more information!